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Syncola crypsimorpha (Meyrick, 1922) (Gelechioidea: Blastobasidae): A new pest species associated with cultured lac in India

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Abstract

A host association for *Syncola crypsimorpha* (Meyrick, 1922) is discovered after 100 years, since its original description. In India, two blastobasid species, *Syncola crypsimorpha* (Meyrick, 1922) and *S. pulverea* (Meyrick, 1907) (Lepidoptera: Gelechioidea), are predators of cultured lac, *Kerria lacca* (Kerr, 1782) (Hemiptera: Kerridae). Descriptions, diagnoses, and images and illustrations of the adult stage, including the male and female genitalia, for these two species are provided to facilitate identifications. A lectotype for *Syncola crypsimorpha* is designated herein.

Key words: adult morphology, Fabaceae, predator, Rhamnaceae, Sapindaceae, scale insects, taxonomy

Introduction

Lac is a biodegradable and natural resin secreted by the insect, *Kerria lacca* (Kerr, 1782) (Hemiptera: Kerridae). In India, there are about 113 host plant sp. n.species of *K. lacca* (Sharma et al. 1997), however the most common tree species include: *Butea monosperma* (Lam.) Taubert (Fabaceae), *Ziziphus mauritiana* Lam. (Rhamnaceae), *Schleichera oleosa* (Lour.) Oken. (Sapindaceae), *Flemingia semialata* Roxb. (Fabaceae) and *Ficus* spp. (Moraceae) (Sharma *et al.*, 1997). Field collected stick lac is processed to produce three valued, natural and renewable products including resin, dye, and wax.

India is the largest producer of lac in the world (Ogle & Thomas 2006). In India, about one million farm families are engaged in lac cultivation. Among the lac growing states, Jharkhand ranks first in lac production followed by Chhattisgarh, Madhya Pradesh, Maharashtra, and West Bengal (Yogi *et al.* 2021).

Among the different species of lac producing insects, *K. lacca* or the Indian lac insect, is the most cultivated insect species for the production of lac in wild and cultivated regions. Two strains of *K. lacca*, *Rangeeni* and *Kusmi* are recognized and used for cultivation in India, based on differential host specificity and asynchronous life cycle (Kapur 1962; Ramani 2005). However, the lac obtained from the Kusmi strain is of higher quality (Dwivedi 1993).

Species of predatory Lepidoptera associated with *K. lacca* include; *Eublemma amabilis* [Moore, 1884], Erebidae, (Glover & Negi 1935; Pierce 1995; Khobragade (2010); *E. roseonivea* (Walker, 1864), (Pierce 1995); *E. scitula*

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Rambur, 1833, Erebidae, (Rambur 1833; Rouzaud 1893; Glover 1933; Pierce 1995); *Catablemma sumbavensis* Hampson, 1903, Erebidae, (Jacobson 1913; Mohanasundarum, Sharma, Meena, & R. Ramani 2016); *Syncola pulverea* (Meyrick, 1907), Blastobasidae (Meyrick 1907; Fletcher 1920b; Imms & Chatterjee 1915; Pierce 1995); *Anatrachyntis falcatella* Stainton, 1859, Cosmopterigidae (Fletcher 1920a; Pierce 1995); *Oedematopoda cypris* Meyrick, 1905, Stathmopodidae (Meyrick 1905; Imms & Chatterjee 1915; Fletcher 1920b; Fletcher 1933); *O. venusta* Meyrick, 1913, Stathmopodidae (Meyrick 1913; Fletcher 1920b; Pierce 1995); *Stathmopoda auriferella* Walker, 1864, Stathmopodidae (see *S. theoris* below); *S. basiplectra* Meyrick, 1913, Stathmopodidae (Meyrick 1913; Imms & Chatterjee 1915; Fletcher 1920b), *S. theoris* Meyrick, 1906, [junior synonym of *S. auriferella*], Stathmopodidae (Fletcher 1920b), and *Lacciferophaga yunnanea* Zagulyaev, 1959, Momphidae (Zagulajev & Din-Si 1959). Among these above species, *Eublemma amabilis* and *Syncola pulverea* are the most economically important pests to the cultivated lac industry in India (Glover 1937; Malhotra & Katiyar 1975; Khobragade 2010).

Meyrick (1907) described *Blastobasis pulverea* from India, placing this species within *Blastobasis*, a genus proposed by Zeller in 1855. Later (Meyrick 1908) transferred *B. pulverea* to *Hypatima* Hübner, 1825. Subsequently, Walsingham & Durrant (1909) transferred *H. pulverea* to *Holcocera* Clemens, 1863. *Pseudohypatopa* was proposed by Sinev (1986) based on the type species, *Holcocera pulverea* (Meyrick, 1907). Upon Zhen and Li's (2008) review of *Pseudohypatopa*, they recognized four species within the genus; two new species, *P. longitubulata* and *P. paulilobata*, along with *P. longicornutella* Park and *P. pulverea* (Meyrick, 1907). More recently, Sinev (2014) recognized *Pseudohypatopa* as a junior synonym of *Syncola* Meyrick, 1916 and *Blastobasis crypsimorpha*, (Meyrick, 1922) a congener of *Syncola pulverea*, thus recognizing the latter two species as new combinations.

Materials and methods

This study is based on reared field-collected larval specimens from different agricultural regions in India where *Kerria lacca* is cultured. Infested samples of stick lac were sorted according to host and location. These collections were stored in wooden boxes (20×20×30 cm) having glass tubes fitted on the front side with one end closed (26.4± 2 ˚C and 43±5% RH). Emerged moths were collected in 5 ml vials and killed in a freezer at -20 ˚C.

For genitalia preparation, the abdomens of male and female adults were separated from the thorax using a pair of micro-cissors, and placed overnight in a test tube containing 10 % KOH solution. Macerated abdomens were transferred to a cavity block containing H_20 where the samples were cleaned and descaled before being transferred to a glycerol depression slide for study. Genitalia were carefully separated from the anterior abdomen using a stereo-binocular microscope. After examination, the abdominal pelt and genitalia were transferred to a microvial containing glycerol and attached to the associated pinned specimen. The terminology of the genitalia follows Klots (1965), Kristensen (2003), and Adamski & Brown (1989). Photographs of the pinned adult specimens and genitalia were taken using a Canon EOS70D digital camera. The Methuen Handbook of Colour (Kornerup and Wanscher 1978) was used as a color standard.

Voucher specimens are deposited in the National Pusa Collection, Division of Entomology, Indian Agricultural Research Institute, New Delhi, India (NPC). Selected specimens were compared with type specimens in the Natural History Museum, London, in the United Kingdom, where accurate identifications of field collected specimens in India could be made. Generic placement of *Syncola crypsimorpha* and *S. pulverea* follows Sinev (2014). The lectotype designation for *Syncola crypsimorpha* is attributed to the second author.

Results

Diagnosis. *Syncola crypsimorpha* is similar to *S. pulverea* by sharing a similar forewing pattern and an absence of a notchlike space demarcated by a modified first flagellomere. It differs from *S. pulverea* by having a less dense setose uncus; a narrower, an unemarginated ventroposterior margin of the gnathos, a wider base to the apical part of the lower part of the valva; a slightly curved sclerite of phallus, with accuminate apices; a membranous antrum; a short, uncoiled ductus bursae; and the absence of a signum on the inner wall of the corpus bursae.

***Syncola crypsimorpha* (Meyrick, 1922)**
(Figs. 1, 3−6, 7−8, 11, 13−14)

Redescription. Adult: Head: (Fig. 3), Vertex and frontoclypeus with grayish-brown scales tipped with pale grayish brown; outer and inner surfaces of labial palpus grayish brown intermixed with grayish brown scales tipped with pale grayish brown and grayish-brown scales along apical margin of second palpomere (Fig. 3); scape of antenna with grayish-brown scales tipped with pale grayish brown, pecten pale yellow, flagellum grayish brown; male first flagellomere unmodified (Fig. 4). Proboscis pale grayish brown.

Thorax: Tegula with grayish-brown scales tipped with pale grayish brown; [mesoscutum with scales missing]. Legs with grayish-brown scales tipped with pale grayish brown intermixed with pale grayish-brown scales near midsegments and apical margins of all segments and tarsomeres. Forewing (Fig. 1), length 6.0−6.2 mm (n=3), patterned with grayish-brown scales tipped with pale grayish brown intermixed with grayish-brown scales; cell with two spots present or absent; if present, cell with one spot near middle and/or on distal end near tornus. Venation (Fig. 5) with a pterostigma between Sc and R_1; R_3 and R_5 connate basally, divergent slightly beyond half length of R_5; M_1 closer to M_2 from beyond base than to R_5; M_3,CuA_1, and CuA_2 connate; CuA_2 separate from CuA_1, and near right angle from Cubitus. Undersurface brown. Hindwing: translucent pale brown. Venation (Fig. 6) with cubitus appearing 4-branched, with M_2 and basal stem of M_3 and CuA_1 connate from posterior intersection of Cubitus and crossvein of cell; M_2 farther apart from M_1 basally, converging from 1/3 to 1/2 length, parallel distally; M_3 and CuA_1connate from about 1/2 length from basal stem.

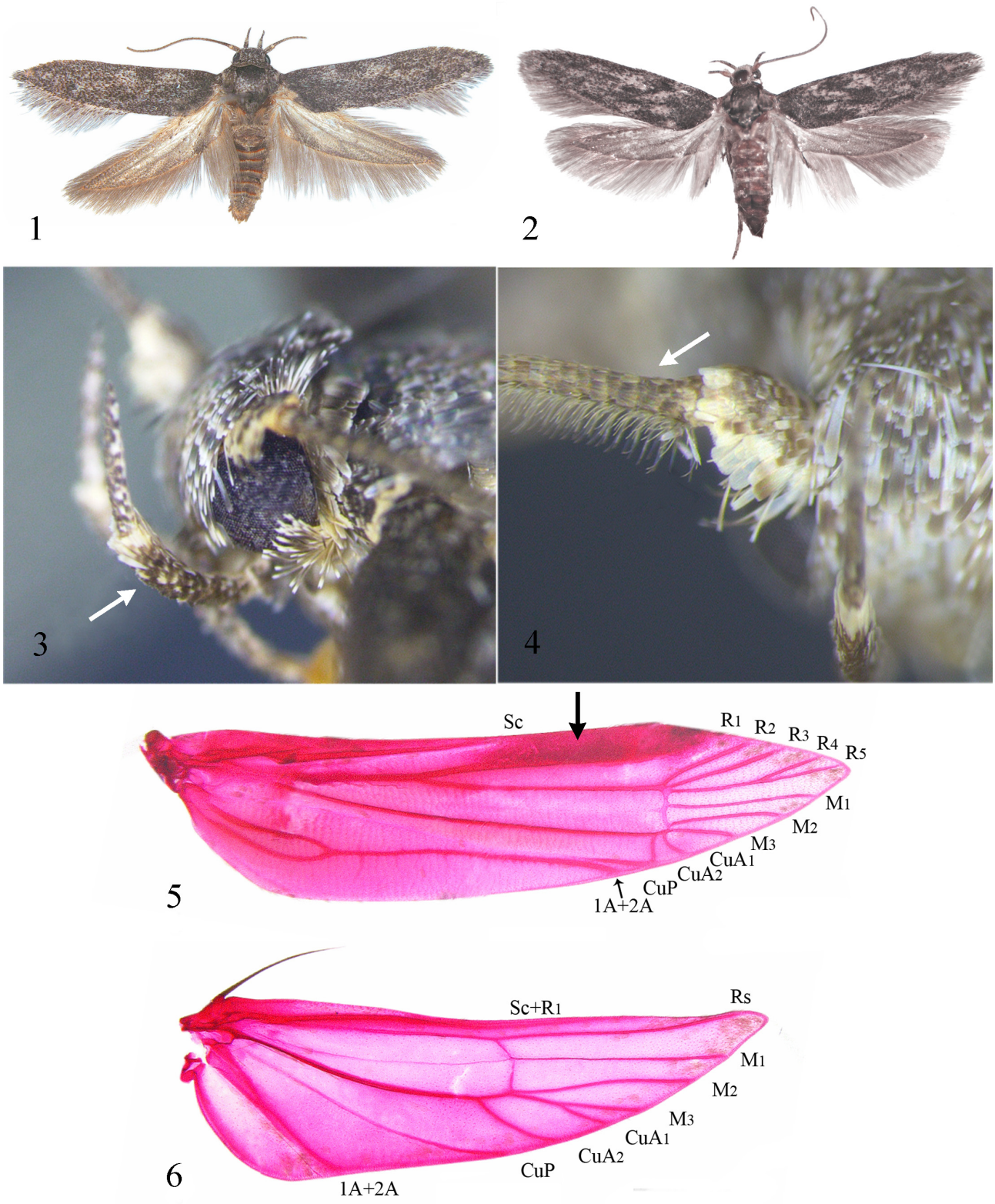
Abdomen: Male with seven irregular rows of spinelike setae on terga 2−7, and three irregular rows of spinelike setae on tergum 8; female with seven irregular rows of spinelike setae on terga 2−6.

Male genitalia: (Figs. 7−8) with uncus setose, widened dorsally, gradually narrowed to an obtuse apex with a keeled edge. Gnathos separated from tegumen by membrane, narrow, entire along ventroposterior margin. Valva divided into an upper part and lower parts; upper part widened basally, gradually narrowed to a broadly rounded apex; densely setose from slightly beyond base to apex; lower part widened basally, slightly narrowed to about 4/5, abruptly constricted, forming a spinelike apical process, acutely curved apically, setose along outer margin of basal 2/3. Vinculum narrowly U-shaped. Juxta platelike, ventral margin nearly straight. Phallus broadly curved, sclerite of phallus wide, bifurcate apically, each bifurcation with acuminate apex; anellus with microsetae.

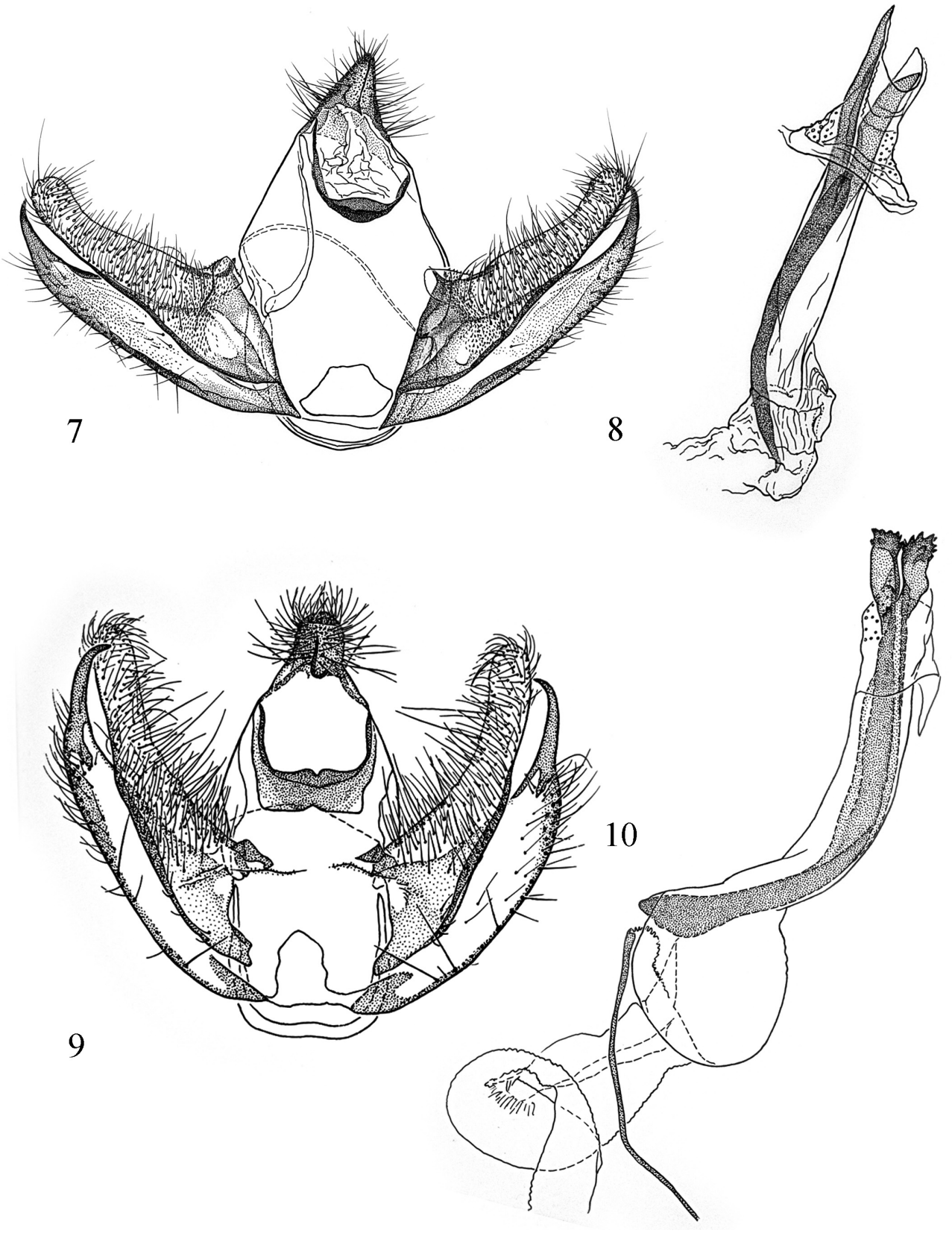
Female genitalia (Fig. 11): with apical part of ovipositor with 3 membranous subdivisions. Papillae anales, two broadly widened, apically setose lobes. Apophyses posteriores long, about 2X length of apophyses anteriores. Ostium in membrane near emarginate anterior margin of eighth sternum, posterior 1/3 setose. Antrum membranous, short, constricted near inception of ductus seminalis; ductus semilalis slightly anterior seventh segment; ductus bursae short, uncoiled. Corpus bursae elongate with a signum absent.

Types examined. Lectotype ♂, designated herein by Adamski, "Lectotype" [round purple-bordered label]; "[India] Murree, Punjab, D[utt], 7500 [feet], 6[June] 19[18]" [hand-written label]; "*Blastobasis crypsimorpha* Meyrick, 3/3, E. Meyrick det., in Meyrick Coll[ection]"; "Meyrick Coll[ection], BM 1938-290"; "*crypsimorpha* Meyr[ick]" [hand-written label]; "BMNH(E) #953886" [DNA sample number]; "BM ♂ Genitalia Slide No. 31993." A lectotype is being designated in order to maintain stability of usage of the name. Paralectotype (1 ♂, 1 ♀): 1 ♂, "Paralectotype" [round blue-bordered label]; "[India] Murree, [Punjab], 7500 f[ee]t, June 18, Dutt Coll."; "Cotype, *Blastobasis crypsimorpha* Meyrick, Meyrick det., 1922"; "3948"; "BM ♂ Genitalia Slide No. 31941"; 1 ♀, "Paralectotype" [round blue-bordered label]; "[India] Murree, [Punjab], D[utt], 7500 f[ee]t, [6]June 18"; "*Blastobasis crypsimorpha* Meyrick, Meyrick det., 2/3, sp. n.E. Meyrick det., in Meyrick Coll[ection]"; "Meyrick Coll[ection], BM 1938-290"; "BM ♂ Genitalia Slide No. 32003."

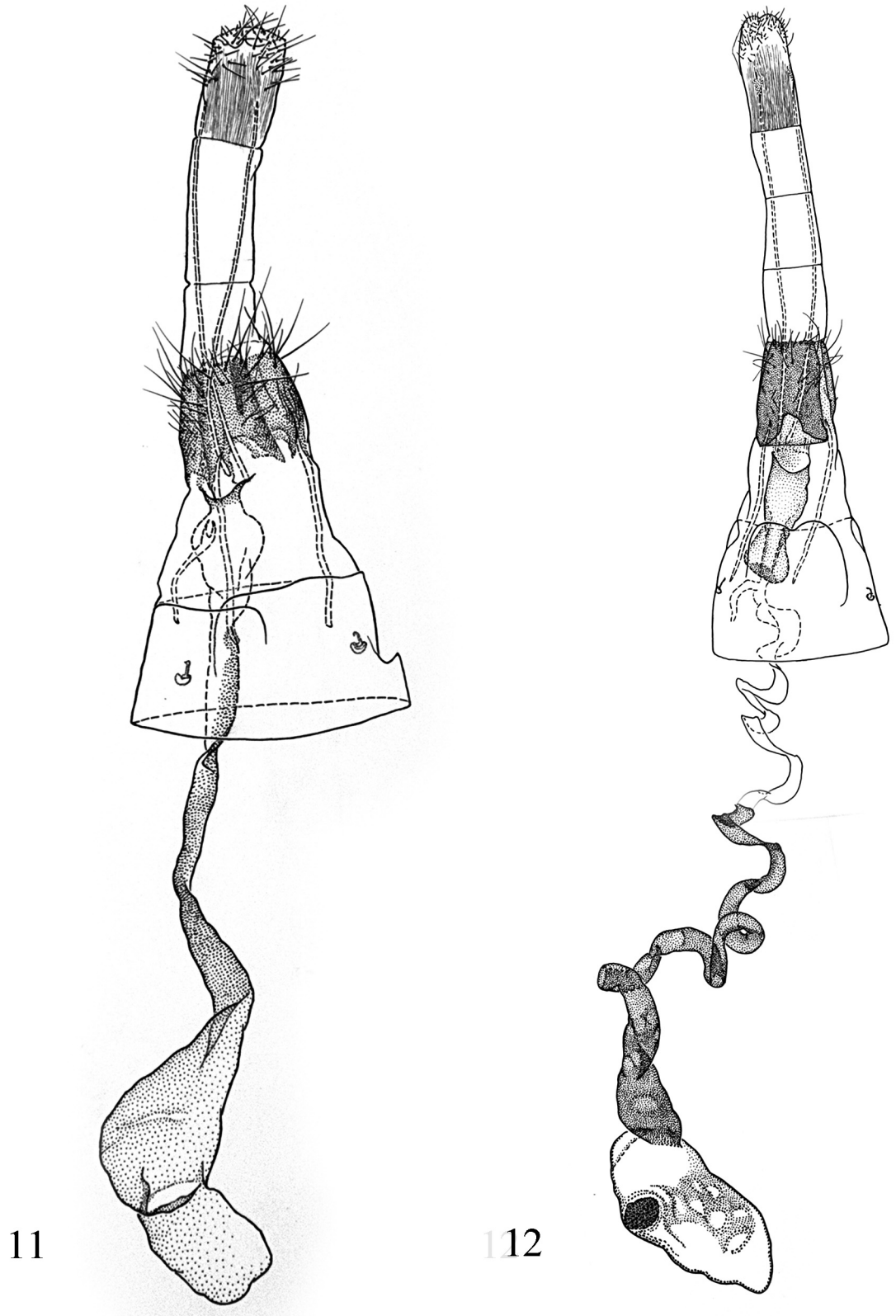
Other specimens examined. INDIA: Karnataka: sp. n.Mundgod (14° 58' 25.32'' N, 75° 2' 26.52'' E), 5♀, 3♂, 17.vi.2018, Host plant: Kusum and *Flemingia semialata,* Lac Strain: Kusmi, Coll. J. Mahesh; **Rajasthan:** Udaipur (24° 34' 16.5720'' N, 73° 41' 29.5584'' E), 5♀, 3♂, 15.xi.2018, Host plant: Ber, Lac Strain: Kusmi, Coll. Vikram; **Jharkhand:** Ranchi (23° 20' 38.7636'' N, 85° 18' 34.4268'' E), 4♂, 5♀, 17.vi.2018, Host plant: Palas and *Flemingia semialata*, Lac strain: Rangeeni and Kusmi, Coll. Mohanasundaram; **Jharkhand:** Ranchi (23° 20' 38.7636'' N, 85° 18' 34.4268'' E), 4♂, 2♀, 17.vi.2018, Host plant: Palas and *Flemingia semialata*, Lac strain: Rangeeni and Kusmi, Coll. Mohanasundaram; **Jharkhand:** Ranchi (23° 20' 38.7636'' N, 85° 18' 34.4268'' E), 3♂, 4♀, 15.xi.2018, Host plant: Palas, Lac strain: Rangeeni, Coll. J. Mahesh; **West Bengal:** Purulia (23° 20' 38.7636'' N, 85° 18' 34.4268'' E), 4♂, 4♀, 25.ii.2019, Host plant: Palas, Lac strain: Rangeeni, Coll. N. Rajgopal; **Gulwara,**



FIGURES 1–6. Adult forewing patterns and adult features of *Syncola crypsimorpha* and *S. pulverea*. 1, Forewing pattern of *S. crypsimorpha*. 2, Forewing pattern of *S. pulverea*. 3, Head of *S. crypsimorpha*, lateral view. Arrow indicates labial palpus extending above vertex of head. 4, Base of antenna showing an unmodfied first flagellomere of *S. crypsimorpha*. Arrow indicates unmodified first flagellomere. 5, Forewing venation of *S. crypsimorpha*. Arrow indicates pterostigma between Sc and R_1. 6, Hindwing venation of *S. sp. n.crypsimorpha*.



FIGURES 7–10. Male genitalia of *Syncola crypsimorpha* and *S. pulverea*. Fig. 7, *S. crypsimorpha*. Genital capsule. Fig. 8, phallus. Fig. 9, *S. pulverea*, Genital capsule. Fig. 10, phallus.



FIGURES 11–12. Female genitalia of *Syncola crypsimorpha* and *S. pulverea*. Fig. 11, *S. crypsimorpha*. 12, *S. pulverea*.

Central Provinces: on Lac, 2♀, 17.III.1907, C.R.D.; **Gulwara, Central Provinces:** on Lac, 1♀, 27.III.1907, C.R.D.; **Pusa Bengal:** on Lac,1♀, 09.IX.1907, G.D.O.; **Pusa Bengal:** on Lac,1♂, 03.IX.1907, G.D.O.; **Pusa Bengal:** on Lac, 1♂, 29.VIII.1911, M.M.L.; **Central Province:** 2♀, Palas lac borer, 17.VIII.1914, Coll. Deputy Conser.; **Central Province:** 1♀, Palas lac borer, 22.VIII.1914, Coll. Deputy Conser.; **Central Province:** 2♂, Palas lac borer,

28.VIII.1914, Coll. Deputy Conser.; **Pusa Bihar:** on Lac, 2♀, 3♂, 19.II.1923, R. Saran coll.; **Pusa Bihar:** on Lac, 1♂, 15.VIII.1912, C.S.M.

Remarks. The larva of *Syncola crypsimorpha* is gray (Fig. 13) compared to the pale yellow color of the larva of *S. pulverea* (Fig. 15). It appears as numerous as the latter species in regions where surveyed. No gross differences in the pupae of both species were detected (Figs. 14, 16). Descriptions of the immature stages of *S. crypsimorpha* are forthcoming when specimens become available.

FIGURES 13–16. Larva and Pupa of *Syncola crypsimorpha* and *S. pulverea*. 13, Larva of *S. crypsimorpha*. 14, Pupa of *S. crypsimorpha*. 15, Larva of *S. pulverea*. 16, Pupa of *S. pulverea*.

Syncola pulverea (Meyrick, 1907)

(Figs. 2, 9–10, 12, 15–16)

Diagnosis. *Syncola pulverea* is similar to *S. crypsimorpha* by sharing a similar forewing pattern and an absence of a notchlike space demarcated by a modified first flagellomere. It differs from *S. crypsimorpha* by having a more densely setose uncus; a wider, and a mesially emarginated ventroposterior margin of the gnathos, a narrower base to the apical part of the lower part of the valva; a broadly curved sclerite of phallus, with spinose apices; a sclerotized antrum; a long, multi-coiled ductus bursae; and a platelike and spinose signum on the inner wall of the corpus bursae.

Redescription. Adult: Head: Vertex and frontoclypeus with brownish-gray scales tipped with white; outer and inner surfaces of labial palpus with scales brownish gray tipped with white intermixed with white scales along apical margin of second palpomere; scape and flagellum of antenna brownish gray, pecten pale yellow; male first flagellomere unmodified. Proboscis brownish gray.

Thorax: Tegula and mesoscutum brownish gray. Legs brownish gray intermixed with pale brownish scales near apical margins of all segments and tarsomeres.

Forewing (Fig. 2), length 6.6−7.8 mm (n=3), with brownish-gray scales tipped with pale brownish gray, and brownish-gray scales; cell with two brownish-gray spots, one near middle, one near distal end near tornus. Undersurface brownish gray. Hindwing translucent grayish brown gradually darkening to apex.

Abdomen: Male with seven irregular rows of spinelike setae on terga 2−7, and three irregular rows of spinelike setae on tergum 8; female with seven irregular rows of spinelike setae on terga 2−6.

Male genitalia (Figs. 9−10) with uncus densely setose, widened dorsally, gradually narrowed to an obtuse apex with a keeled edge. Gnathos separated from tegumen by membrane, shallowly notched medially along ventroposterior margin. Valva divided into an upper part and lower part; upper part widened basally, gradually narrowed to a broadly rounded apex; densely setose from slightly beyond base to apex; lower part widened basally, gradually narrowed to about 4/5, abruptly constricted, forming a spinelike apical process, acutely curved apically, setose along outer margin of basal 2/3. Vinculum narrowly U-shaped. Juxta platelike, ventral margin emarginate. Phallus broadly curved, base bulbous; sclerite of phallus wide, dilated apically into a bifurcate process; process obtuse, apically spinose; anellus with microsetae.

Female genitalia (Fig. 12) with apical part of ovipositor with three telescopic subdivisions. Papillae anales, two broadly widened, apically setose lobes. Apophyses posteriores long, slightly more than 2X length of apophyses anteriores. Ostium in membrane near emarginate anterior margin of eighth sternum, posterior 1/3 setose. Antrum sclerotized, elongate to near inception of ductus seminalis, slightly anterior to seventh segment. Ductus bursae multicoiled. Corpus bursae elongate with platelike signum.

Types examined. Lectotype ♀, "Lectotype" [round purple-bordered label]; "India, *Tachardia lacca*, EE Green, [19]04" [hand-written label]; "*Holcocera pulverea* Meyrick, 4/18 E. Meyrick det., in Meyrick Coll[ection]"; "Meyrick Coll[ection], BM 1938-290"; "BMNH(E) #953891" [DNA sample number]; "BM ♂ Genitalia Slide No. 31999." Paralectotypes (1 ♂,1 ♀), 1 ♂, "Paralectotype" [round blue-bordered label], "India, *Tachardia lacca*, EE Green, 7 [July] [19]02" [hand-written label]; "*Holcocera pulverea* Meyrick, 8/18 E. Meyrick det., in Meyrick Coll[ection]"; "Meyrick Coll[ection], BM 1938-290"; "BM ♂ Genitalia Slide No. 32018"; 1 ♀, "Paralectotype" [round blue-bordered label], "India, *Tachardia lacca*, EE Green, 7 [July][19]02" [hand-written label]; "*Holcocera pulverea* Meyrick, 2/18 E. Meyrick det., in Meyrick Coll[ection]"; "Meyrick Coll[ection], BM 1938-290" [abdomen within a gelatin capsule]. Specimen not dissected.

Remarks. Mishra & Gupta (1934) documented the biology of *Syncola pulverea* and Adamski *et al.* (2020) provided detailed descriptions and illustrations of the larva, pupa, and the adult of this species, in addition to providing details on its biology on cultured lac in northern Thailand. The larva of *S. pulverea* is pale yellow (Fig. 15) compared to the gray larva of *S. crypsimorpha* (Fig. 13). No gross differences in the pupae of both species were detected (Figs. 14, 16).

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